

European Location Framework – One Reference Geo-Information Service for Europe

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Abstract. The European Location Framework (ELF) project will during the next three years deliver the first implementation of the European Location Framework (Jakobsson, 2012) - a technical infrastructure which harmonises national reference data to deliver authoritative, up-to-date, interoperable, cross-border geospatial reference data for use by the European public and private sectors in a way that is easy to use by application developers and even end users.

The project will provide a critical mass of content and coverage as 15 Member States' national INSPIRE data will be made available from a single point connecting the ELF platform to the European Commission INSPIRE geo-portal, the Commission Internal portal run by Eurostat and ArcGIS Online, a commercial Cloud GIS platform. Covering the full range of INSPIRE Annex I,II and III themes, these datasets will provide full national coverage of the rich content available from national and regional spatial data infrastructures

Keywords: INSPIRE, Platform, Framework, SDI, Europe, Content, Cloud GIS

1. Introduction

Today access to authoritative geo-information is mostly national. The INSPIRE directive is requiring that there will be national services set up used for creating cross-border and pan-European services. In the ESDIN (2011) project this scenario was examined and the conclusion was that there is a need for setting up geo-tools and additional specifications for creating op-

erational cross-border and pan-European services. The European Location Framework (ELF) project will set up these services and specifications.

The project consortium consists of 30 partners: 16 National Mapping and Cadastral Authorities (NMCAs), 4 application developers, 4 commercial software providers and 6 organizations representing user groups and regional bodies.

2. Data Specifications for Global, European and Cross-border Harmonization

Making national geo-information assets available across Europe through a technical infrastructure is challenging. EuroGeographics and its members know from their production experience that utilisation of national data in a global, European or regional cross-border context poses additional requirements for data aggregation (Pammer et.al. 2009, Hopfstock et.al. 2012).

The ELF specifications are a set of technical specifications setting the requirements for data provision and aggregation through the envisaged technical infrastructure. They encompass data specifications for master and regional/global level of details, data maintenance and processing specifications as well as product and service specifications.

2.1. Need for Harmonized Cross-border Data Specifications

The ELF data specifications (ELF DS) aim at facilitating the interoperability of topographic, administrative and cadastral reference data according to the requirements set in the INSPIRE directive and to other user requirements at regional, European and global levels. The ELF DS describe the conceptual data model for creating harmonised cross-border, cross-theme and cross-resolution pan-European reference data from national contributions. Thus, the ELF DS are important to ensure a coordinated approach regarding harmonisation of the NMCA's data and services in matters of content, geometric resolution and quality.

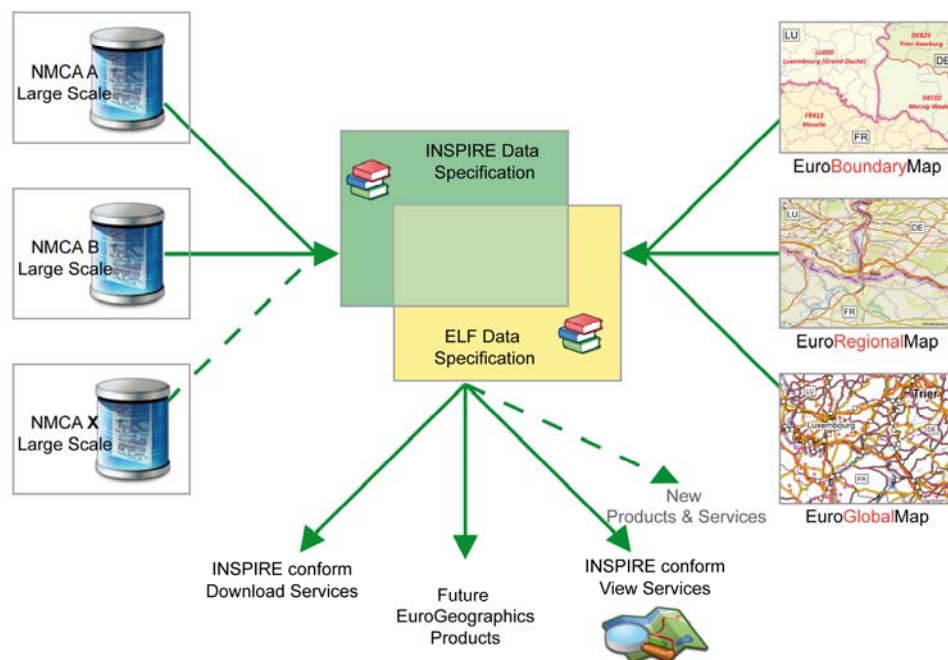


Figure 1. Common and integrated ELF DS (Hopfstock et.al. 2012)

In ESDIN (2011) a first common and integrated data model for all level of details based on the INSPIRE data specifications for Annex I (INSPIRE Annex I DS) was created (*Figure 1*). In a first step, the relationship between the existing EuroGeographics pan-European data sets and the INSPIRE Annex I DS v3.0 was analysed.

In summary, the existing EuroGeographics product specifications partly overlap with the INSPIRE Annex I DS in terms of the data harmonisation components as well as the content (feature and attributes). On one hand, ELF DS do not cover the overall range of INSPIRE themes but focuses on the topographic, administrative and cadastral reference data in the remit of the NMCAs. On the other hand, ELF DS Regional/Global includes additional themes and feature types due to known user requirements for the existing products. In the course of the ELF project these data specifications are going to be revised and amended according to the changes in INSPIRE, the new INSPIRE DS for Annex II and III as well as new user requirements.

2.2. Maintenance and Processing Specifications

The ELF DS are accompanied by data maintenance and processing specifications which define the processes between the actors in order to achieve the data interoperability and harmonisation required for the pan-European

products and services. Hopfstock et.al. (2012) discussed the concepts of these interoperability processes such as data transformation, data aggregation and edge-matching, generalisation, and data validation in the light of service-oriented technologies.

2.3. Product and Service Specifications

Finally, the ELF DS provides the basis for creating user-oriented pan-European products by EuroGeographics and its members. While based on the ELF DS the product and service specifications may vary in their geographic and thematic scope depending on the demands and requirements of the users. The development of a Map for Europe providing a topographic basemap for viewing and backdrop reference is a key product and service (Hopfstock, 2010).

2.4. Expected Benefits

The ELF DS put the INSPIRE obligations at cross-border and European level into practice. Based on these specifications the ELF platform will support the one-stop production of, and access to authoritative topographic, administrative and cadastral reference data that is

- Seamless and consistent across borders enabling spatial analysis in a global, European and regional cross-border context;
- Consistent between themes, so that different themes can be used together;
- Consistent between resolutions, so that a feature present on national level is present at European regional and global level if it should be present according to selection criteria;
- Up-to-date, maintained and quality ensured enabling users to meet their requirements.

EuroGeographics and its members expect from the implementation of the ELF DS and interoperability processes a more effective and cost efficient production and data maintenance. Besides, conformance to the ELF DS will enable NMCAs to fulfil their INSPIRE obligations.

3. Geo-Tools for Interoperability

The ELF DS based on extensions to existing INSPIRE rules and guidelines will be agreed and then applied via Geo-tools to existing local national services to enable cross-border interoperability. The ELF platform's Geo-tools will be based on extensions to existing services (as developed in ESDIN

2011) for the required data transformation, validation (quality evaluation), generalisation and edge-matching.

3.1. Quality Validation and Evaluation

ESDIN (2011) project introduced a semi-automatic quality evaluation process comprising of a quality model (to be described by data producers), a data quality web service (for evaluation), reporting results in metadata and finally a data user web service, which would help users to evaluate the quality of data.

Utilizing this approach the NMCAs can achieve high quality geographic information quickly, realise the advantages of investments and reduce operating costs in the long run. The users will a) rely on data that is trusted and usable b) achieve improved spatial analysis and c) be confident in decision making (Beare et al. 2010b, Jakobsson et al. 2011).

In the ELF project quality evaluation will be operationalized using cloud based commercial services. The goal is also to introduce a standard way in which quality models can be expressed as rules, which enables using these in multiple software environments.

3.2. Generalisation

ESDIN (2011) has shown that it is possible to put a generalisation process in place that can automate or semi-automate the production of small-scale data from the updates of larger scale holdings (Kereneur, 2011). This generalization process is now implemented in the EuroGeographics Reference Data Production Programme and first themes of EuroGlobalMap based on EuroRegionalMap were delivered end of 2012. In ELF we will investigate how generalisation can be introduced for production of EuroRegionalMap.

3.3. Geo Product Finder

The Geo Product Finder (GPF) is a concept developed in ESDIN (2011) combining legal and technical resources to provide the “missing links” in finding and utilising data and services without replacing what is already working well. (Aslesen, VanExcel 2011). This includes how to find the relevant services for the users’ needs, including a user friendly interface for metadata, and being guided directly to the data or where it can be acquired, depending upon existing structures and the licensing terms for the product.

In the ELF project this will be developed into a tool that will enable users to easily find and access the products and services provided by the ELF platform.

3.4. Secure Access

It is important to have a system capable of controlling access to use of the services, to provide for restricted access to restricted products, licensing, use of framework agreements, etc. In ESDIN (2011) a concrete solution for secure access control was demonstrated using Security Assertion Markup Language (SAML) and the Open Source Shibboleth implementation. This is based on the idea of access management federation as an organisational model (Higgins, 2011). Further work for introducing of secure access control for the ELF platform will be done in the project.

3.5. Edge-matching

For sustainable edge-matching maintenance, agreed boundary representations are needed. ESDIN proposes a work process for improving data consistency between neighbouring countries before a fully automated edge-matching process can take place. Stability at the boundaries is achieved by maintaining a “Euro Cross-Boundary Database” of connecting ‘control’ features (Beare et al. 2010). An example can be found in the ESDIN final report (ESDIN, 2011).

EuroGeographics is already working on providing a state boundaries dataset to be available at national level, based on treaties and large scale topographic/cadastral dataset, and European regional level, based on EuroBoundaryMap and EuroRegionalMap.

3.6. Visualisation

Visualisation of the geographical information is very important for the users. In ELF we will use Styled Layer Descriptor (SLD) for describing the appearance of the map layers. This will enable ELF platform to support data visualisations based on varied user requirements. For example statistical analyses might need different visualisation than emergency reference maps.

4. Global/European/Cross-border Data and Services

Figure 2 illustrates the data and service offering available from the ELF platform. This offering will be implemented in three phases. Phase I will provide existing pan-European data from EuroGeographics by September 2013. Phase II will provide data from the NMCAs participating in the project. In this phase we will provide access to national level of details for the first time in Europe. Phase III will extend the data offering to other national and commercial data providers.

Content		Products/Services	
Themes		EuroGlobalMap	ELF Platform
Admin. Units	Hydrography	EuroRegionalMap	Data Services
Geographical Names	Transport Networks	EuroBoundaryMap	ELF basemap
Transport Networks	Elevation	International Boundaries	GeoLocator Service
Vegetation	Settlements	EuroDEM	
Settlements		ELF toposo	
Other content		ELF International Boundaries	
		ELF Cadastral Europe	

Figure 2. ELF Data and Services

5. ELF Platform and ELF-based Services

The output ELF reference geo-information datasets will be published via cloud GIS service platforms (Open Source Oskari Platform and ArcGIS Online), which will be available and maintained for valued added application development.

5.1. ELF Platform

ELF platform will consist of two Tiers (*Figure 3*). Tier 1 contains National services which support the ELF specifications offering the content described earlier. Tier 2 will host the infrastructure needed to join-up the national services including service cascading, the Oskari platform and the GeoLocator service.

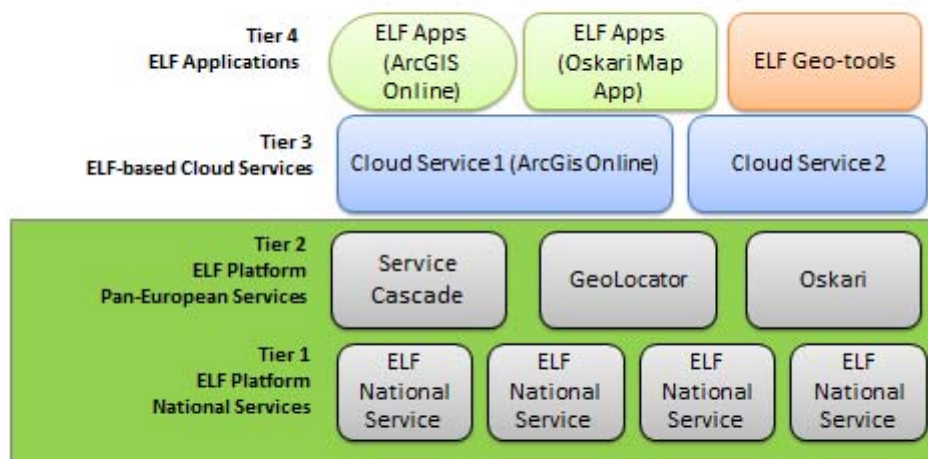


Figure 3. ELF Technical Architecture and ELF Platform

Oskari is an abbreviation from words open source map window (in Finnish **Open source karttaikkuna**). It is an Open Source JavaScript Map Application Framework and a Java-based Spatial Data Service Platform providing the services needed to implement map and visualization services in the Finnish Spatial Data Infrastructure (SDI). As a general framework it can be used to implement map and visualisation services for any SDI.

Oskari will be used for the ELF platform to provide a demonstration portal at www.locationframework.eu and it can be used for the application development offering embedded web maps.

Geolocator service will provide georeferencing services needed for the ELF platform. It will be based on geographical names, addresses and administrative units. EuroGeographics has been working on the EuroGeoNames service since 2006 and currently 17 countries are providing access to their geographical names. Since end of 2012 the service infrastructure has been hosted in the cloud. During the ELF project the GeoLocator Service will encompass the EuroGeoNames service.

5.2. ELF Cloud Services

The data and services of the NMCAs provided by the ELF Platform will also be made available via a widely used, secure Software-as-a-Service (SaaS) cloud GIS platform, ArcGIS Online (ESRI 2013). In the future, ELF data and services may also be made available via other cloud GIS platforms.

The cloud service platforms are central data hubs of the ELF infrastructure, integrating data and services from many NMCAs and capable of providing

data and services to many applications and a very large number of users. They complement the INSPIRE offerings of the NMCAs in several aspects:

- By using cloud computing technologies to serve any number of concurrent users as needed;
- By providing developer-friendly APIs that allow application developers - including those unfamiliar with GIS – to rapidly develop applications for the web or mobile platforms using ELF data;
- By providing application templates and the capability that allows application developers or even end-users to create and publish ELF-based web applications without any programming skills;

The cloud services (*Figure 4*) will use data that is harvested from the national services in the ELF Platform and that will be kept up-to-date based on change feeds that are part of the ELF Platform.

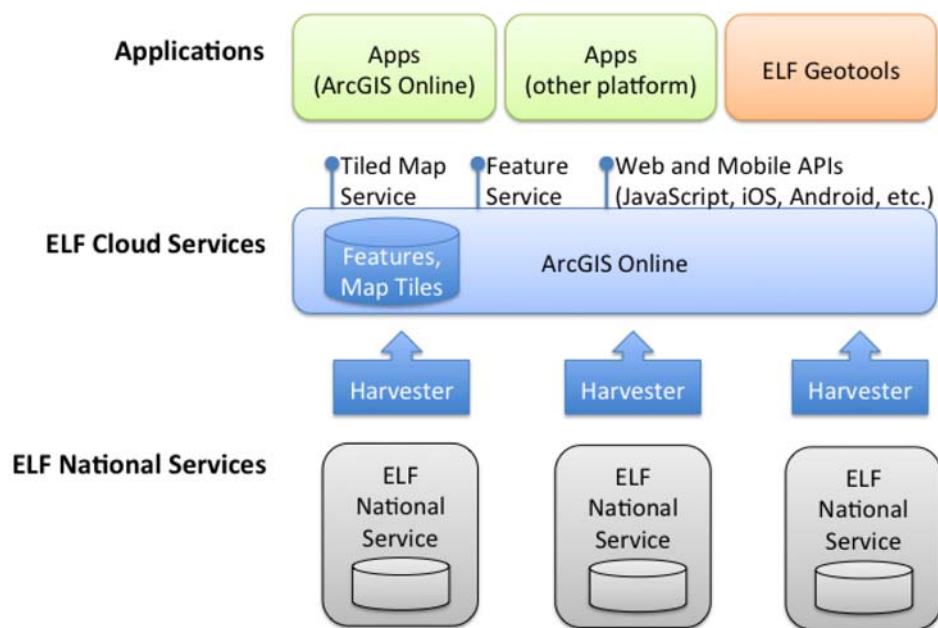


Figure 4. ELF cloud services

6. Use of and Extending the ELF Data and Services

As described earlier, ELF will enable users to access authoritative data from the NMCAs based on common specifications through the ELF Platform. Everyone involved realizes that this is truly a challenge! In ESDIN (2011)

project the user requirements for cross-border and European data and services were examined (Hartnor & Eriksson, 2010).

Some valued added services based on pre-existing services in the domains of the Health Statistics, Emergency Mapping, Insurance and Real Estate will be developed during the project demonstrating the capability of the ELF platform. However any kind of value-added services could be developed on the top by stakeholders. The intention is to attract as many application developers as possible and to the extent possible assist them in making use of the ELF information. To this end, the project will strive to make thematic and other data from different third party sources available and to use many different channels to inform potential application developers.

Additional (non-NMCAs) geo-information will become available enabling the integration of existing services from national SDI's, other commercial and non-commercial sources. Their inclusion will be negotiated via agreements in order to maximise the number of INSPIRE themes available via the ELF Platform. To provide a full multi-lingual capability, the ELF Platform will make use of the INSPIRE feature concept dictionary and extend the existing 'EuroGeoNames' service to the GeoLocator service.

7. Sustaining the ELF Platform

The project is aligned well with the Digital Agenda for Europe, the European Interoperability Framework, eGovernment and Cross border service initiatives, Copernicus (GMES), Eurostat and SEIS requirements, INSPIRE and PSI principles, and with the Intelligent transport, Agriculture and other EU policies and initiatives. The project will work on sustaining the developed services by creating the necessary agreements and engaging the political decision makers.

In ESDIN (2011) it was explored how a sustainable policy for providing data and services could be established and maintained. This included looking at best practices, analyzing licenses and licensing requirements and developing the concept for the GPF (Aslesen et al. 2010).

The ELF project will provide a sustainable policy framework which will allow data to flow freely through the platform to the users. This will include:

1. Agreement with and between data providers to ensure delivery of the data and services according to the technical specifications and legal constraints.
2. Service level agreements which will regulate what the providers need to do as well as what the users can accept.

3. Legal and administrative issues considering access to the data and services.
4. GPF, a tool for finding, comparing and accessing services from the platform.

Data and services can be accessed by several means. A number of data and services will be open and available without payment or restrictive licenses. These will be accessed directly with the help of the GPF. One of the aims of the project is to facilitate an increasing amount of such services.

Other services may require a license, which can be provided in several ways, through an existing framework agreement on national or European level, through a web shop, a distributor or the data providers own interface. The GPF will direct the user to where the license can be required or to the access point of the service if the user already has an agreement allowing access.

8. Conclusions

The ELF project is a major vehicle to implement the vision of EuroGeographics “to achieve interoperability of our Members’ national land and geographical information assets in order to provide Europe with an information asset that will support its goal to become the most competitive and sustainable economy in the world”. During next 3 years we will introduce an operational infrastructure based on best practices from ESDIN project and national INSPIRE implementations. It will be a first large scale implementation of INSPIRE based services for cross-border, European and Global use. This also brings a challenge because there is a longer implementation period of national services. However we believe that ELF will change the landscape of the European reference data and bring authoritative data to European citizens.

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